Growth Adapted Tensegrity Structures - A New Calculus for the Space Economy

Completed Technology Project (2013 - 2014)

Project Introduction

We describe a novel approach to create and engineer an economically viable space habitat development technology, for deployment of a lightweight tensegrity habitat structure orbiting at Earth-Moon L2, where onboard robotic assets will use space based materials to provide water for shielding, irrigation and life support, soil for ecosystem development, and to enable structural maintenance and enhancement. The habitat can become a tourist destination, an economic hub, and a multi-purpose research and support facility for lunar surface development and space ecosystem life sciences. Tensegrity engineering is a newly established discipline pioneered by one of the authors - with the mathematical rigor to deliver safe minimal mass structures. We will use and expand these analytical tools to accomplish our stated research objectives. We will create new devices for providing momentum control through the tensegrity structure. We will describe "space capable" robotic processes to enable autonomous fabrication and construction of tensegrity structures from asteroidal regolith. We will devise new hull structures for protection from the space environment, and accompanying strategies for interaction with the thermal and radiation environment. The capability, flexibility and adaptability that this new technology represents, coupled with parallel developments in mining of space based resources, private sector launch capability and the nascent space tourism industry, can introduce the component of early date free space habitats into the space economy, resulting in new calculations of economic possibility.

Anticipated Benefits

Humans in the near future will live on constructed earth-grade real estate in space, either orbiting above Mars, or at any of the myriad potential locations in the solar system offering desirable strategic benefits. This technology could be an enabling factor in human settlements beyond planet earth.

Concept Drawing

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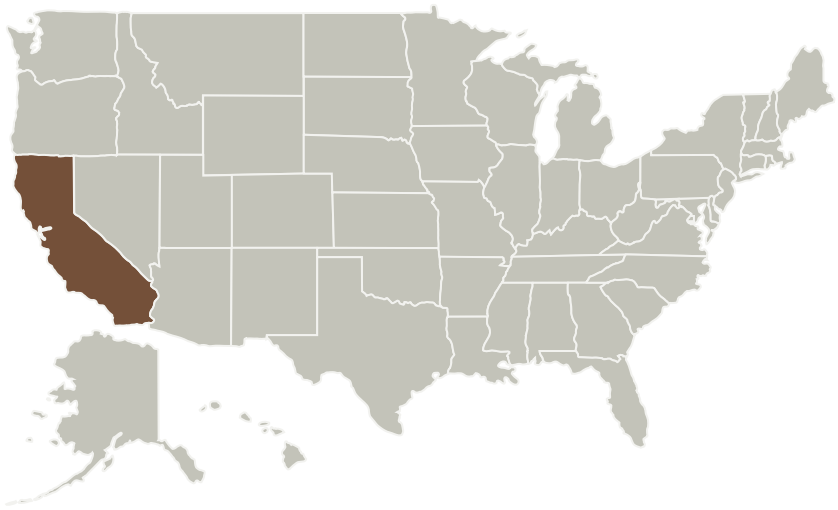
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Texas A & M University-College Station(Texas A&M)	Lead Organization	Academia	College Station, Texas

Primary U.S. Work Locations
California

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Texas A & M University-College Station (Texas A&M)

Responsible Program:

NASA Innovative Advanced Concepts

Project Management

Program Director:

Jason E Derleth

Program Manager:

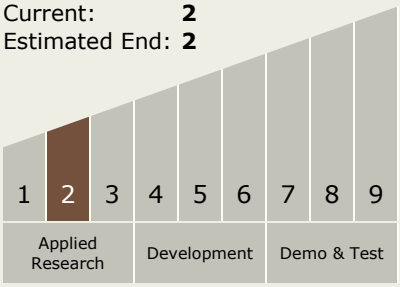
Eric A Eberly

Principal Investigator:

Anthony Longman

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **2**



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Images

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Concept Drawing
(https://techport.nasa.gov/image/102216)

Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.2 Mission Infrastructure, Sustainability, and Supportability
    - TX07.2.3 Surface Construction and Assembly

Target Destinations

Earth, Others Inside the Solar System